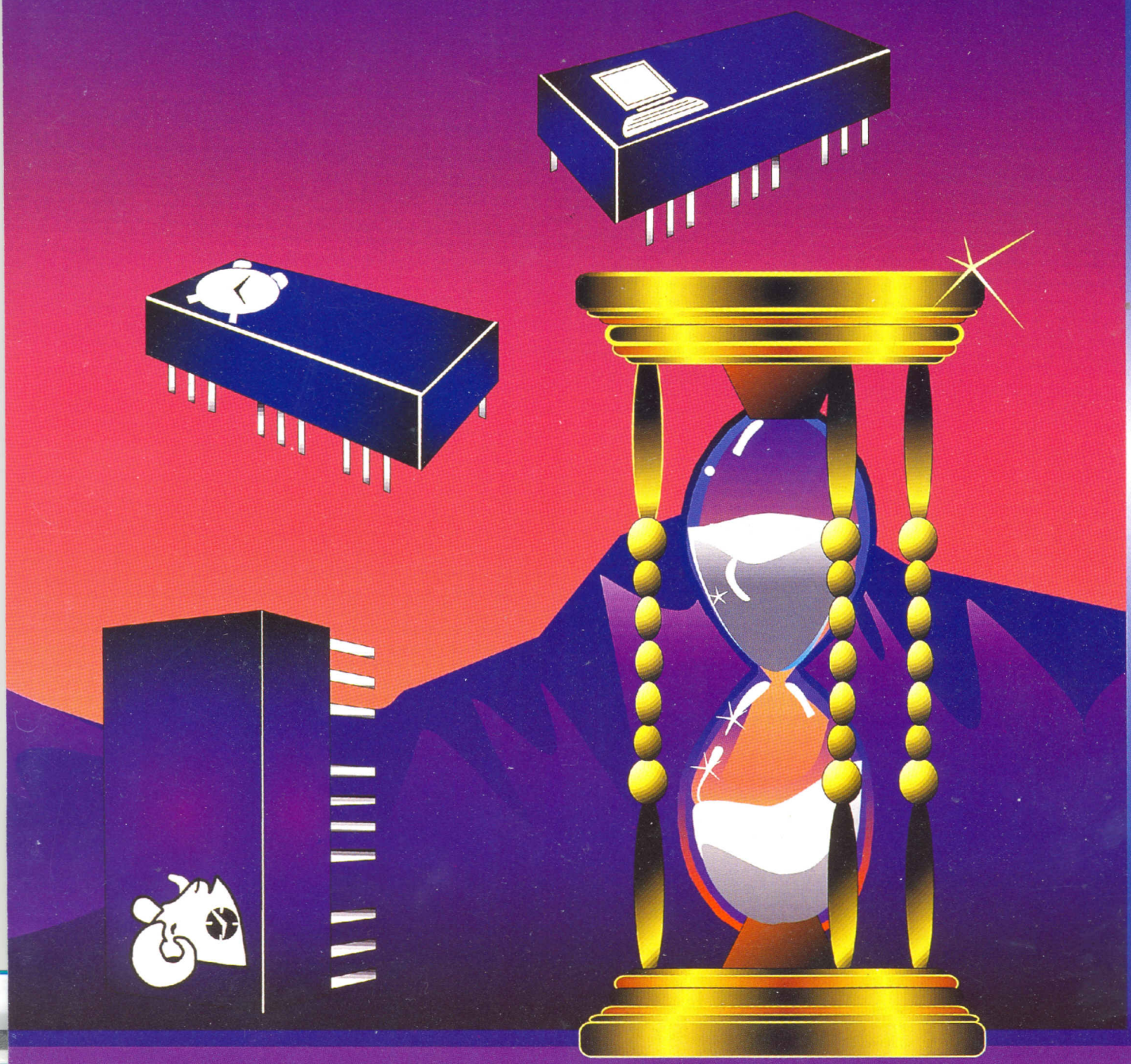
TIMEKEEPING

FAMILY OVERVIEW



DALLAS SEMICONDUCTOR

DALLAS SEMICONDUCTOR

4401 South Beltwood Parkway
Dallas, Texas 75244-3292
Tel: 214-450-0448
FAX: 214-450-3715

Literature & Technical Support: 214-450-0448
Sales & Customer Service: 214-450-0969
Automatic Data Sheet Faxback: 214-450-0441
Corporate FTP Site: ftp://ftp.dalsemi.com
Worldwide Web Site: http://www.dalsemi.com
E-Mail Communication: firstname.lastname@dalsemi.com

DALLAS SEMICONDUCTOR

Family Overview

Timekeeping Products

PC Real Time Clocks

Serial Clocks

Phantom Clocks

NV Timekeeping RAMS

Watchdog Timekeepers

Dallas Semiconductor has been the leader in providing Real Time Clocks for a broad range of applications since 1985. The Company's proprietary timekeeping CMOS circuits consume current at the nano-ampere level during periods of inactivity. As a result, they can be powered by a small lithium cell for more than 10 years, longer than the useful life of most equipment. Because of this longevity, equipment manufacturers do not have to design provisions for battery replacement into their products. In addition to modules that combine circuits with lithium and quartz, Dallas Semiconductor offers timekeeping chips.

Dallas Real Time Clocks can be powered by a small lithium cell for more than 10 years.

Dallas timekeeping devices count in seconds, minutes, hours, day of the week, date, month, and year in BCD and/or binary form. Many of the devices also provide 24- or 12-hour clock selection, AM and PM notations, corrections for Daylight Savings Time, and leap year compensation. Each timekeeping product family provides a range of user NV RAM configurations to help match system design requirements. A variety of interfaces are directly supported, including PC ISA and EISA, bytewide, phantom, parallel, 3-wire, 2-wire and 1-wire.

In addition to the clock/calendar functions, many devices incorporate special features.

- **Unique, laser-programmed serial numbers ensure that no two devices are alike**
- **Programmable time-of-day and watchdog interrupts**
- **Kickstart input allows systems to be activated from an external stimulus such as a modem ring detect signal**
- **Square wave outputs used for system time purposes**
- **Elapsed time and V_{CC} cycle counters act as run-time meters**
- **Nonvolatile control for external SRAM**
- **A/D conversion**

INSIDE. . .

Timekeeping Selection Guide

	PART NUMBER	POWER OPTIONS	CLOCK FORMAT[1]	CALENDAR FORMAT[2]	USER RAM (BYTES)
SERIAL CLOCKS	DS1202	2V-5V	STD	STD	24
	DS1302	3V-5V	STD	STD	31
	DS1305	3V-5V	STD	STD	96
	DS1306	3V-5V	STD	STD	96
	DS1307	5V	STD	STD	56
	DS1602	5V	BINARY	BINARY	
	DS1603	5V	BINARY	BINARY	
	DS1608	3V-5V	BINARY	BINARY	512
	DS1670	3V	STD	STD	
	DS2404	3V-5V	BINARY	BINARY	512
PHANTOM CLOCKS	DS1215	5V	STD+hh	STD	
	DS1216B	5V	STD+hh	STD	2K, 8K†
	DS1216C	5V	STD+hh	STD	8K, 32K†
	DS1216D	5V	STD+hh	STD	8K, 32K, 128K,512K†
	DS1216E	5V	STD+hh	STD	ROM: 8K, 32K†
	DS1216F	5V	STD+hh	STD	ROM: 8K, 32K, 128K†
	DS1243Y	5V	STD+hh	STD	8K
	DS1244Y	5V	STD+hh	STD	32K
	DS1248Y	5V	STD+hh	STD	128K
	DS1251	5V	STD+hh	STD	512K
	DS1315	3V, 5V	STD+hh	STD	
TIMEKEEPING NV RAM	DS1642	5V	STD	STD	2K
	DS1643	5V	STD	STD	8K
	DS1644	5V	STD	STD	32K
	DS1646	5V	STD	STD	128K
	DS1647	5V	STD	STD	512K
WATCHDOG TIMEKEEPERS	DS1284	5V	STD+hh	STD	50
	DS1286	5V	STD+hh	STD	50
	DS1384	5V	STD+hh	STD	50
	DS1386	5V	STD+hh	STD	8K, 32K
	DS1486	5V	STD+hh	STD	128K
PC REAL TIME CLOCKS	DS12885	5V	STD	STD	114
	DS12887	5V	STD	STD	114
	DS12887A	5V	STD	STD	114
	DS1385	5V	STD	STD	50+4K
	DS1387	5V	STD	STD	50+4K
	DS1485	5V	STD	STD	50+8K
	DS1488	5V	STD	STD	50+8K
	DS14285	5V	STD	STD	114
	DS14287	5V	STD	STD	114
	DS1585	5V	STD	STD	114+8K
	DS1587	5V	STD	STD	114+8K
	DS1685	3V, 5V	STD	STD	114+128
	DS1687	3V, 5V	STD	STD	114+128
	DS1688	3V, 5V	STD	STD	114
	DS1689	3V, 5V	STD	STD	114
	DS1691	3V, 5V	STD	STD	114
	DS1693	3V, 5V	STD	STD	114
	DS17285	3V, 5V	STD	STD	114+2K
	DS17287	3V, 5V	STD	STD	114+2K
	DS17485	3V, 5V	STD	STD	114+4K
	DS17487	3V, 5V	STD	STD	114+4K
	DS17885	3V, 5V	STD	STD	114+8K
	DS17887	3V, 5V	STD	STD	114+8K

**** TYPES OF INTERRUPTS:***

A - TIME OF DAY ALARM: Programmable interrupt is activated when the time of day matches the programmed alarm registers.

WD - WATCHDOG: Interrupt occurs after a programmed interval if the real time clock's watchdog registers are not accessed.

WU - WAKE-UP: An internal alarm designed to wake up the system at a specified time/date.

KS - KICKSTART: An external signal to the real time clock causes an interrupt output which turns on the system power supply.

I - INTERVAL: Interval timer can automatically accumulate time when power is applied to the real time clock.

INTERRUPTS*	NV SRAM CONTROL	SERIAL NUMBER	BUS TYPE	OTHER
			3-WIRE	
			3-WIRE	Contact factory for low voltage version
A x 2			3-WIRE OR SPI	Contact factory for low voltage version
A x 2			3-WIRE OR SPI	Contact factory for low voltage version
			2-WIRE	
			3-WIRE	
			3-WIRE	
A, I, CC		X	3- OR 1-WIRE	
A, WD, RESET	X		3-WIRE	3-CHANNEL A/D, CPU RESET
A, I, CC		X	3- OR 1-WIRE	
	X		PARALLEL/PHANTOM	
			PARALLEL/PHANTOM	
			PARALLEL/PHANTOM	
			PARALLEL/PHANTOM	
			PARALLEL/PHANTOM	
			PARALLEL/PHANTOM	
			PARALLEL/PHANTOM	
			PARALLEL/PHANTOM	
			PARALLEL/PHANTOM	
	X		PARALLEL/PHANTOM	
			PARALLEL/BYTEWIDE	
			PARALLEL/BYTEWIDE	
			PARALLEL/BYTEWIDE	
			PARALLEL/BYTEWIDE	
			PARALLEL/BYTEWIDE	
A, WD			PARALLEL/BYTEWIDE	
A, WD			PARALLEL/BYTEWIDE	
A, WD	X		PARALLEL/BYTEWIDE	
A, WD			PARALLEL/BYTEWIDE	
A, WD			PARALLEL/BYTEWIDE	
A,P,U			PARALLEL/MUX'ED	
A,P,U			PARALLEL/MUX'ED	
A,P,U			PARALLEL/MUX'ED	
A,P,U			PARALLEL/MUX'ED	
A,P,U			PARALLEL/MUX'ED	
A,P,U			PARALLEL/MUX'ED	
A,P,U			PARALLEL/MUX'ED	
A,P,U	X		PARALLEL/MUX'ED	
A,P,U	X		PARALLEL/MUX'ED	
A,P,U,KS,WU,RC		X	PARALLEL/MUX'ED	
A,P,U,KS,WU,RC		X	PARALLEL/MUX'ED	
A,P,U,KS,WU,RC		X	PARALLEL/MUX'ED	
A,P,U,KS,WU,RC		X	PARALLEL/MUX'ED	
A,P,U,KS,WU,RC	X	X	PARALLEL/MUX'ED	
A,P,U,KS,WU,RC	X	X	PARALLEL/MUX'ED	
A,P,U,KS,WU,RC	X	X	PARALLEL/MUX'ED	
A,P,U,KS,WU,RC	X	X	PARALLEL/MUX'ED	
A,P,U,KS,WU,RC		X	PARALLEL/MUX'ED	
A,P,U,KS,WU,RC		X	PARALLEL/MUX'ED	
A,P,U,KS,WU,RC		X	PARALLEL/MUX'ED	
A,P,U,KS,WU,RC		X	PARALLEL/MUX'ED	
A,P,U,KS,WU,RC		X	PARALLEL/MUX'ED	

CC - CYCLE COUNTER: Programmable cycle counter can accumulate the number of system power-on/off cycles.

P - PERIODIC: Programmable period interrupt which occurs from 500 ms to 122 µs.

U - UPDATE IN PROGRESS: Allows the user to determine if the real time clock is ready to perform an update cycle.

RC - RAM CLEAR: A RAM clear interrupt is generated when the real time clock has completed a RAM clear operation.

RESET - Reset activated when an out-of-tolerance Vcc condition is detected.

† DS1216s will accept ROM or static RAM of sizes indicated.

Notes:

1. STANDARD CLOCK FORMAT (HH:MM:SS; HH-HOURS, MM-MINUTES, SS-SECONDS), hh-HUNDREDTHS
2. STANDARD CALENDAR FORMAT (dd:MM:DD:YY; dd-DAY OF WEEK, MM-MONTH, DD-DATE OF MONTH, YY-YEAR)

What's Available in PC Real Time Clocks?

- **DS12885/DS12887** *Real Time Clock*
- **DS1685/DS1687** *3V/5V Plug and Play Real Time Clocks*
- **DS17285/DS17287** *3V/5V Plug and Play Real Time Clocks*
- **DS17485/DS17487** *3V/5V Plug and Play Real Time Clocks*
- **DS17885/DS17887** *3V/5V Plug and Play Real Time Clocks*
- **DS1585/DS1587** *Serialized Real Time Clock*
- **DS1688/DS1691, DS1689/DS1693** *3V/5V Serialized Real Time Clocks with NV RAM Control*
- **DS14285/DS14287** *Real Time Clock with NV RAM Control*
- **DS1385/DS1387, DS1485/DS1488** *RAMified Real Time Clocks*

DS12885/DS12887 Real Time Clock

Features

Direct replacement for the DS1285/DS1287

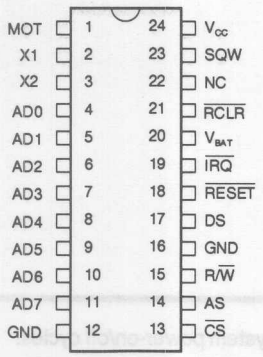
- ♦ Direct replacement for the DS1285/DS1287
- ♦ 12- or 24-hour clock with AM and PM in 12-hour mode plus Daylight Savings Time option
- ♦ Selectable between Motorola and Intel bus timing
- ♦ Multiplex bus for pin efficiency
- ♦ Interfaced with software as 128 RAM locations
  - 14 bytes of clock and control registers
  - 114 bytes of general-purpose RAM
- ♦ Programmable square wave output signal
- ♦ Bus-compatible interrupt signal ($\overline{IRQ}$)

DS12885

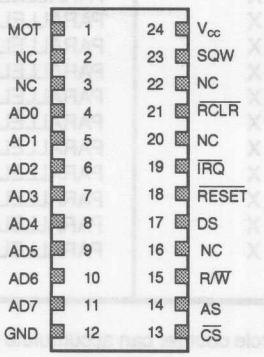
- ♦ Identical in form, fit, and function to the DS1285
- ♦ Additional 64 bytes of general-purpose RAM

DS12887/DS12887A

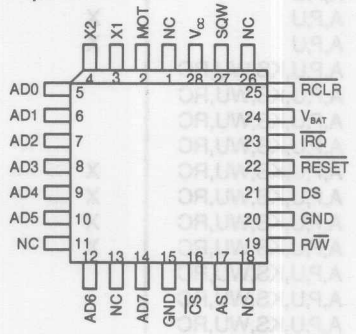
- ♦ Standalone modules
- ♦ Embedded lithium battery and quartz crystal maintain the real time clock and RAM data in the absence of power



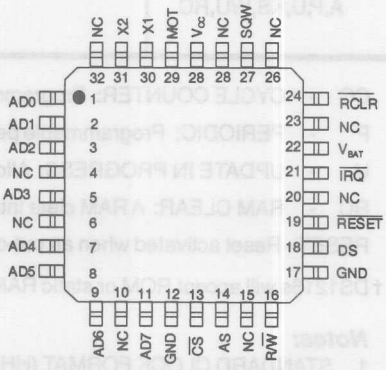
24-pin DIP
24-pin SOIC



24-pin Encapsulated DIP



28-pin PLCC



32-pin TQFP

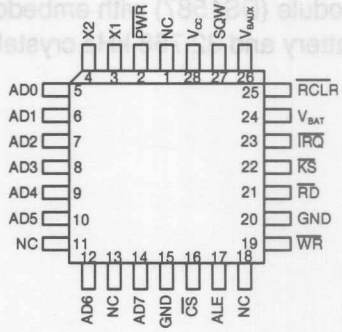
DS1685/DS1687, DS17285/DS17287, DS17485/DS17487, DS17885/DS17887
3V/5V Plug and Play Real Time Clocks

Features

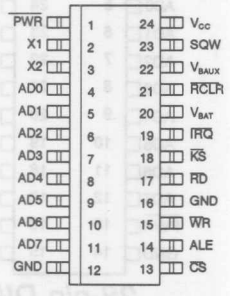
Incorporate the industry-standard DS1285/DS1287 PC clock plus additional features:

- 64-bit silicon serial number
- 114 bytes of user RAM
- Additional extended general-purpose RAM:
  128 bytes (DS1685, DS1687)
  2K bytes (DS17285, DS17287)
  4K bytes (DS17485, DS17487)
  8K bytes (DS17885, DS17887)
- Burst mode feature available when accessing the extended RAM (DS17x8x devices only)
- Century counter and date alarm
- Power control circuitry supports system power-on from a date/time alarm or a key closure
- +3 or +5-volt operation
- Available as chip (DS1685, DS17285, DS17485, DS17885) or standalone module with embedded battery and 32.768 kHz crystal (DS1687, DS17287, DS17487, DS17887)
- Provides an easy upgrade path for systems requiring more memory without any hardware modifications
- Pin configuration closely matches the DS12885/DS12887
- Outputs a 32 kHz square wave signal each time system power is applied
- Ideal devices for systems with processors requiring a clock at power-up

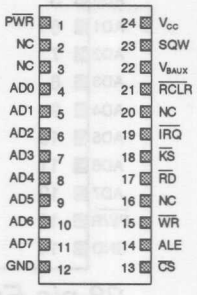
Provides systems with various extended RAM densities accessible via software



28-pin PLCC
(DS1685 ONLY)



24-pin DIP
24-pin SOIC
24-pin TSSOP(DS1685 ONLY)
28-pin TSOP(DS17x85 ONLY)



24-pin Encapsulated DIP

DS1585/DS1587 Serialized Real Time Clock

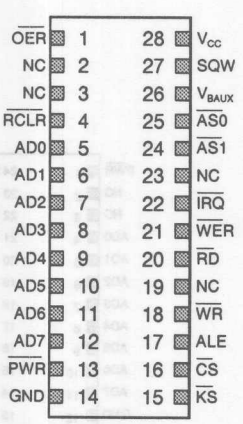
Features

Incorporate the industry-standard DS1285/ DS1287 PC clock plus additional features:

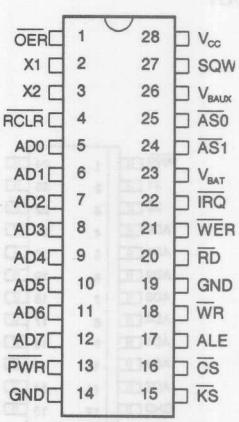
- Unique, 64-bit silicon serial number
- Power on/off control circuitry
- 114 bytes of user RAM

Provides 8K bytes of RAM accessible via software

- Additional 8K bytes of extended general-purpose RAM which can be accessed directly using four control lines or through software via three internal registers
- 32 kHz square wave output available for power management
- Available as chip (DS1585) or standalone module (DS1587) with embedded lithium battery and 32.768 kHz crystal



28-pin Encap. DIP
28-pin SOIC



28-pin DIP

DS1688/DS1691, DS1689/DS1693 3V/5V Serialized RTCs with NV RAM Control

Features

Incorporate the industry-standard DS1287 PC clock plus additional features:

- 128-bit silicon serial number
- 114 bytes of user RAM
- Century counter
- Date alarm
- Power-on elapsed timers for providing valuable information for maintenance and warranty requirements
- Power cycle counter
- Power control circuitry supports system power-on from a date/time alarm or a key closure
- Automatic backup and write protection for an external SRAM
- +3 or +5-volt operation
- Automatically senses the correct operating voltage based on the V_{CC} input voltage
- Available as chip (DS1688, DS1689) or standalone module with embedded lithium battery and 32.768 kHz crystal (DS1691, DS1693)

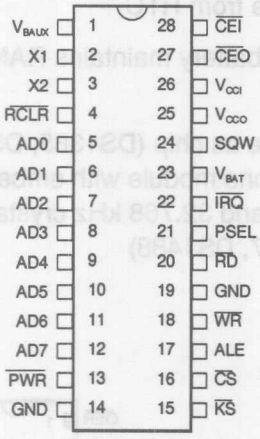
DS1688/DS1691

- Outputs a 32 kHz square wave signal each time system power is applied
- Ideal device for systems with processors requiring a clock at power-up

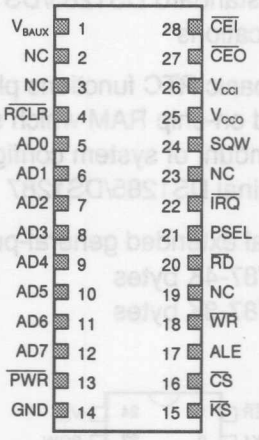
DS1689/DS1693

- Allows user to selectively program the square wave output after system power is applied

Power-on timers provide information for maintenance and warranty tracking



28-pin DIP
28-pin SOIC



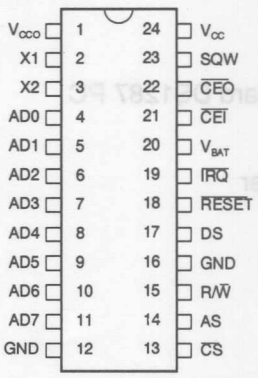
28-pin Encap. DIP

DS14285/DS14287 Real Time Clock with NV RAM Control

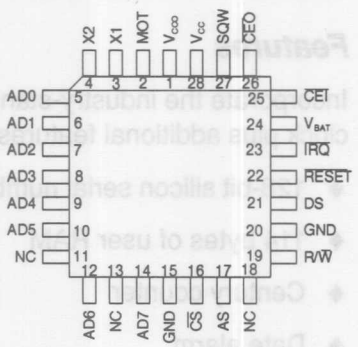
Provides nonvolatile control for standard CMOS static RAMs

Features

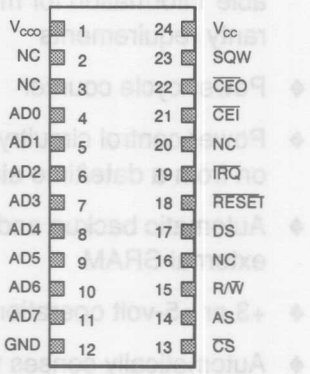
- Incorporate the industry-standard DS1285/DS1287 PC clock
- Additional 64 bytes of general-purpose RAM
- NV RAM controller allows any standard CMOS static RAM to be write protected and nonvolatized during power fail conditions
- External SRAM is write-protected by controlling the chip enable signal
- Maintain V_{CC} power supply for the external SRAM
- Lithium battery connected to DS14285 or internal battery in the DS14287 maintains SRAM data when system power is removed
- Available as chip (DS14285) or standalone module (DS14287) with embedded lithium battery and 32.768 kHz crystal



24-pin DIP
24-pin SOIC



28-pin PLCC



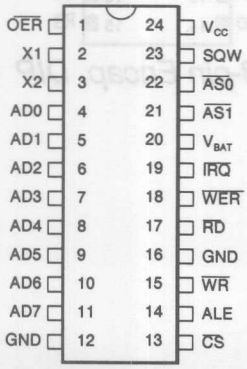
24-pin Encapsulated DIP

DS1385/DS1387, DS1485/DS1488 RAMified Real Time Clocks

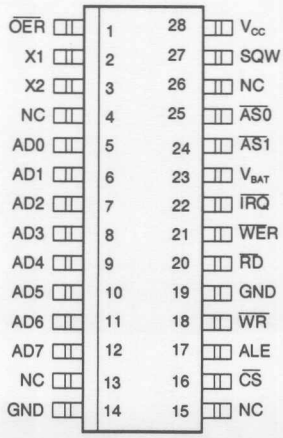
Provides extended on-chip RAM accessible via four control lines

Features

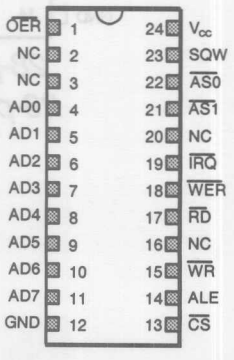
- Upward-compatible successors to the industry-standard DS1285/DS1287 RTCs for PC applications
- Include basic RTC functions plus additional extended on-chip RAM which stores a much larger amount of system configuration data than original DS1285/DS1287
- Additional extended general-purpose SRAM:
  DS1385/87-4K bytes
  DS1485/87-8K bytes
- Access to RAM via four control signals separate from RTC
- Lithium battery maintains RAM for nonvolatile storage
- Available as chip (DS1385, DS1485) or standalone module with embedded lithium battery and 32.768 kHz crystal (DS1387, DS1488)



24-pin DIP



28-pin SOIC

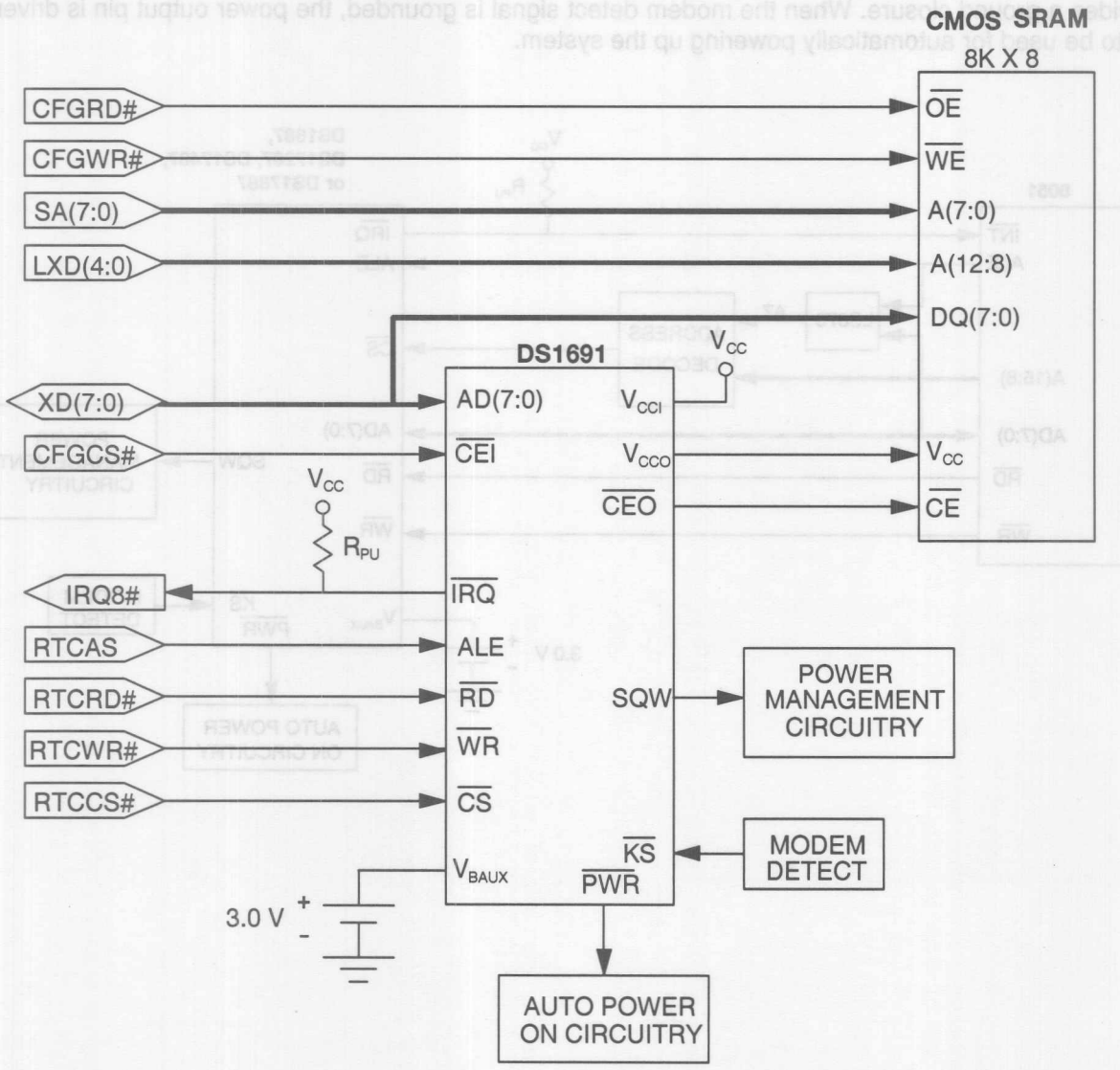


24-pin Encapsulated DIP

Application #1: Nonvolatizing Memory with the DS1691

The following PC system example illustrates how the DS1691 can be interfaced with a standard SRAM to nonvolatize the memory. When the system power is shut down and V_{CC} falls below 4.25V, the CMOS SRAM is automatically write-protected and battery-backed, providing the nonvolatile control. A 32 kHz square wave signal is output on the SQW pin each time the system power V_{CC} is applied and can be used for power management purposes. The kickstart input monitors a modem detect signal that provides a ground closure. When the modem detect signal is grounded, the power output pin is driven low to be used for automatically powering up the system.

Real time clock and NV RAM control convert standard CMOS SRAM into nonvolatile memory.

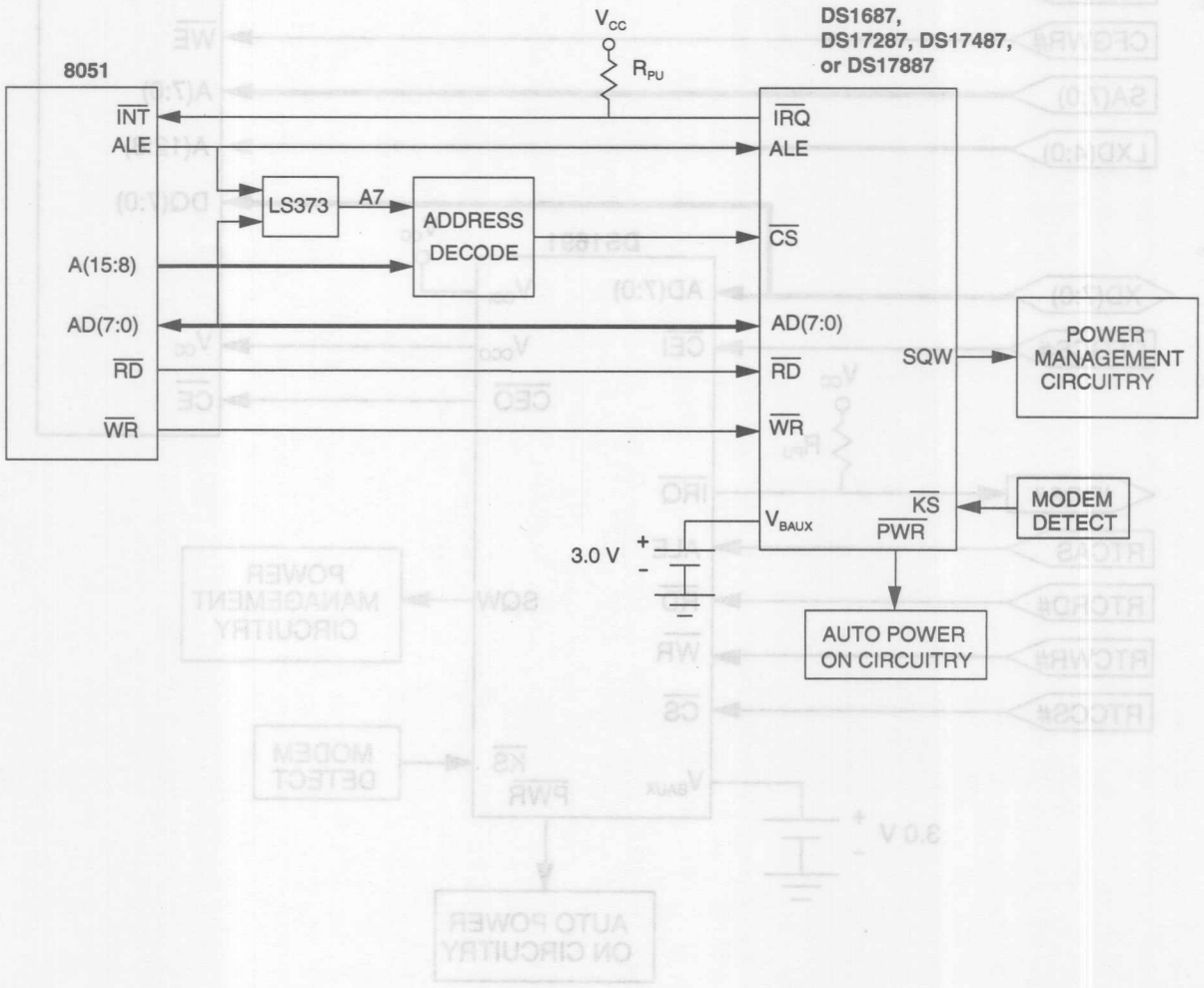


Application #2: Interfacing the DS1687, DS17287, DS17487, or DS17887 with an 8051 Microcontroller

The following system example illustrates how the DS1687, DS17287, DS17487, or DS17887 can be interfaced with an 8051 microcontroller. This particular example requires that 128 bytes of memory map be reserved for the Real Time Clock and the extended NV SRAM. The extended NV SRAM can be accessed using three internal registers via software. The RAM address uses two registers and the data is read or written using the third. The software access method reduces hardware complexity and provides an easy upgrade path for various memory densities. The DS1687 provides 128 bytes of extended NV SRAM while the DS17287, DS17487 and DS17887 provide 2K, 4K, and 8K bytes of extended NV SRAM, respectively.

Simple interface for communicating with an 8051 microcontroller

A 32 kHz square wave signal is output on the SQW pin each time the system power V_{CC} is applied and can be used for power management purposes. The kickstart input monitors a modem detect signal that provides a ground closure. When the modem detect signal is grounded, the power output pin is driven low to be used for automatically powering up the system.

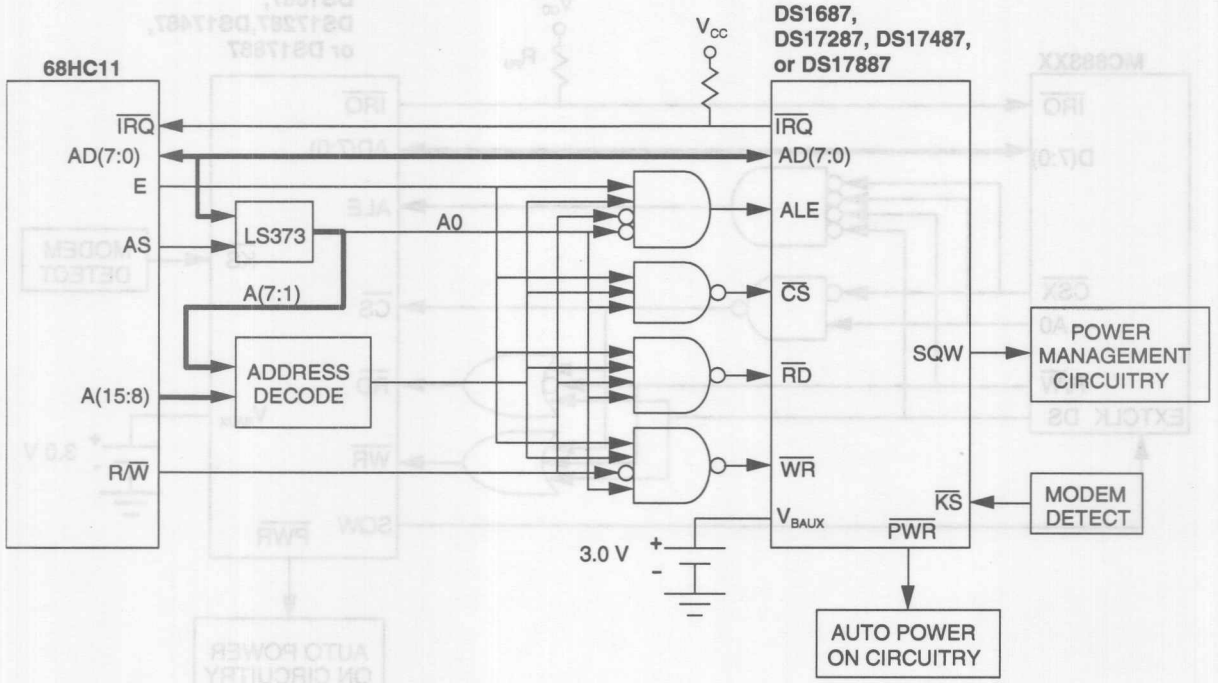


Application #3: Interfacing the DS1687, DS17287, DS17487, or DS17887 with a 68HC11 Microcontroller

The following system example illustrates how the DS1687, DS17287, DS17487, or 17887 can be interfaced with a 68HC11 microcontroller. This particular example requires only two bytes of memory map to be reserved for the Real Time Clock (RTC) and the extended NV SRAM. The two bytes of memory map will be decoded and when the LSB of the address is a logic zero, the RTC address will be latched; when the LSB of the address is a logic one, the data communication will occur. The extended NV SRAM can be accessed using three internal registers via software. The RAM address uses two registers and the data is read or written using the third. The software access method reduces hardware complexity and provides an easy upgrade path for various memory densities. The DS1687 provides 128 bytes of extended NV SRAM while the DS17287, DS17487, and DS17887 provide 2K, 4K, and 8K bytes of extended NV SRAM, respectively.

Interface circuitry maps the real time clock to require only two bytes of memory map space.

A 32 kHz square wave signal is output on the SQW pin each time the system power V_{CC} is applied and can be used for power management purposes. The kickstart input monitors a modem detect signal that provides a ground closure. When the modem detect signal is grounded, the power output pin is driven low to be used for automatically powering up the system.



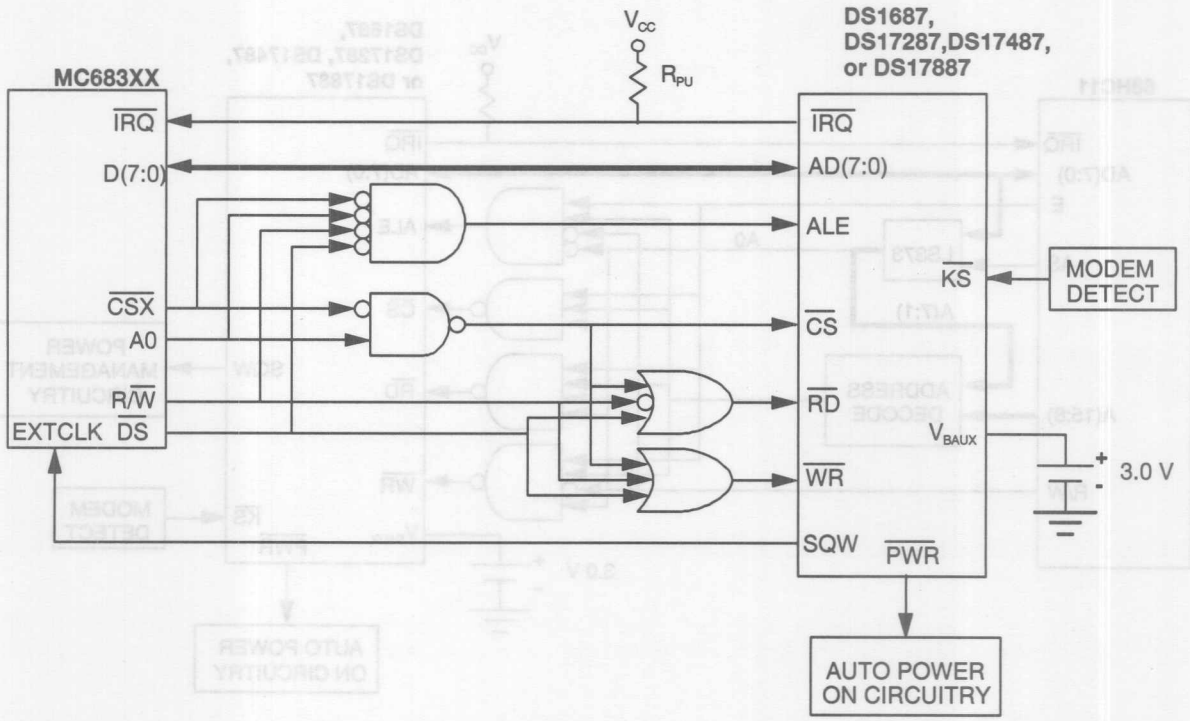
Application #4: Interfacing Motorola MC683XX Processor to the Dallas Clock

This system example illustrates how to interface the Motorola MC683XX processor family containing a non-multiplexed address/data bus to a Dallas Real Time Clock (RTC) with a multiplexed address/data bus. By using one of the chip select signals, $\overline{CSX}$, the external interface logic required for communications is greatly simplified as shown below. This logic can be easily implemented with most programmable logic devices (PLDs). The DS1687, DS17287, DS17487, and DS17887 RTC are pin and functionally equivalent; the only difference is the extended RAM density. This provides an easy RAM density upgrade path without any hardware modification required.

Real time clock provides a 32 kHz output to be used for the system clock

The MC683XX processors have an on-chip Phase Lock Loop (PLL) capable of being driven with an external oscillator. The Dallas RTCs mentioned above provide a 32 kHz square wave signal on the SQW pin each time system power V_{CC} is applied. Together with the PLL and the 32 kHz square wave signal, system power consumption can be reduced and hardware eliminated while still providing the processor with a system clock.

The kickstart input, $\overline{KS}$, monitors a modem detect signal which provides a ground closure. When the modem detect signal is grounded, the power output pin, $\overline{PWR}$, is driven low and can be used to automatically power up the system or as a processor interrupt input.



What's Available in Serial Clocks?

- **DS1202, DS1302** *Serial Time Chips*
- **DS1305, 1306** *Serial Alarm Real Time Clocks*
- **DS1307** *64 x 8 Serial Real Time Clock*
- **DS1602/DS1603** *Elapsed Time Counter*
- **DS1608/DS2404** *EconoRAM Time Chips*
- **DS1670** *Portable System Controller*

DS1202, DS1302 Serial Time Chips

Features

- Provide standard low-power clock/calendar functions along with 24 bytes (DS1202) or 31 bytes (DS1302) user RAM
- Communicate with a microprocessor via a simple 3-wire serial interface
- Real time clock/calendar provides seconds, minutes, hours, day, date, month, and year information
- Data can be transferred to and from clock/RAM one byte at a time or in a burst mode that reads/writes the entire clock/RAM during a single access cycle
- 3V to 5V operation

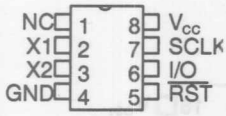
DS1302

Functionally equivalent to the DS1202 with additional features:

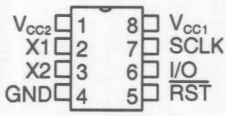
- Provides an additional pin that connects through a trickle charge circuit to a rechargeable energy source such as a NiCad battery or a supercap
- Can be backed up with a standard 3V lithium energy source by disabling the trickle charge circuit
- Optional 2.0- to 5.5-volt full operation available

A trickle charge circuit to a rechargeable energy source

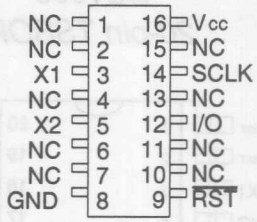
Note: The DS1302 is recommended over the DS1202 for new designs.



DS1202
8-pin DIP
8-pin SOIC



DS1302
8-pin DIP
8-pin SOIC



DS1202
16-pin SOIC

DS1305, DS1306 Serial Alarm Time Clocks

Time-of-day alarm interrupts to wake up a system

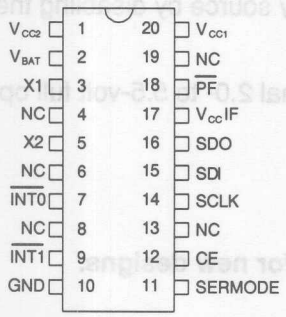
Features

- Provide standard clock/calendar functions along with 96 bytes of user RAM
- Hardware-selectable communication interface: 3-wire serial or 4-wire SPI (Serial Peripheral Interface)
- Two time-of-day alarms with interrupt outputs—programmable on combination of second, minute, hour, and day of the week
- Dual power supply pins for primary and backup power. Optional trickle charge output to backup power supply
- Interface logic power supply input for mixed suppply systems
- Optional 2.0- to 5.5-volt full operation available

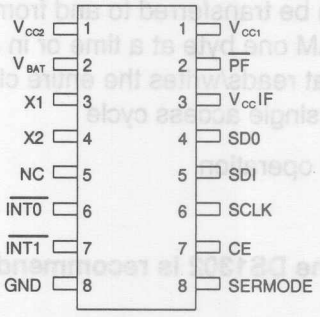
DS1306

Functionally equivalent to the DS1305 with additional features:

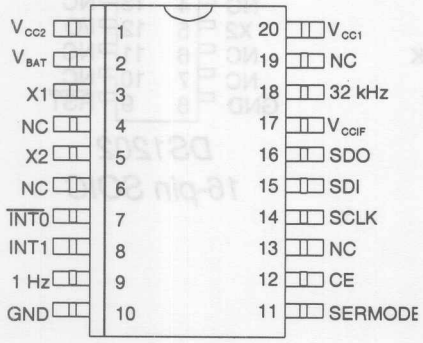
- 1 Hz and 32 kHz square wave outputs
- 1 active high and 1 active low interrupt output



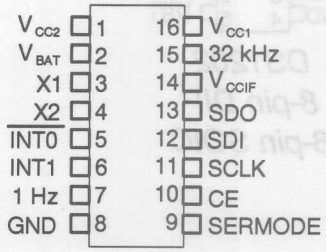
DS1305
20-pin TSSOP



DS1305
16-pin DIP



DS1306
20-pin TSSOP



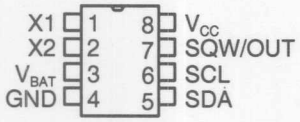
DS1306
16-pin DIP

DS1307 64 x 8 Serial Real Time Clock

Features

- Low-power clock/calendar
- 56 bytes of nonvolatile user RAM
- Addresses and data are transferred serially via a 2-wire, bi-directional bus
- Clock/calendar provides seconds, minutes, hours, day, date, month, and year information
- Built-in power sense circuit detects power failures and automatically write protects the device and switches to the battery supply
- Provides a simple, low-cost solution to adding a low-power, nonvolatile clock/calendar to a 2-wire system
- 5V operation

Low-cost solution to adding a low-power, nonvolatile clock/calendar to a 2-wire system

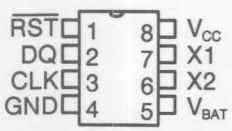


8-pin DIP
8-pin SOIC

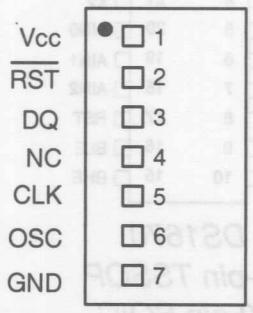
DS1602/DS1603 Elapsed Time Counter

Features

- Perform as real time clock and power-active counter/meter
- Contain two 32-bit counters:
  - one maintains real time in the presence of V_{CC} or while in battery backup mode
  - one counts only when V_{CC} is active and can be used to monitor the active time of a device for warranty and billing applications
- Can be read and written directly by a microprocessor using a simple 3-wire interface
- Provide a means of quickly and simply adding time/date as well as tracking power-on time for a product
- Clear function resets selected counter to zero
- One-byte protocol defines read/write, counter address and software clear function
- Read/write serial port affords low pin count
- 5V operation



DS1602
8-pin DIP
8-pin SOIC



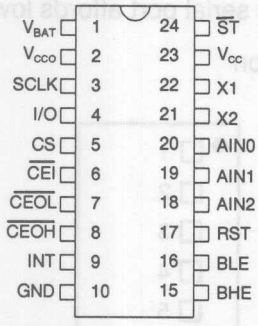
DS1603
7-pin SIP

DS1670 Portable System Controller

Integrated RTC and system control elements found in most portable products

Features

- Provides standard clock/calendar function with second, minute, hour, day, date, month, and year information
- CPU monitor provides reset control for out-of-tolerance V_{cc} conditions and a watchdog timer with interrupt to detect out-of-control software states
- Contains a 3-channel, multiplexed 8-bit A/D converter with 10 ms conversion time
- Performs nonvolatile backup control to external SRAM
- Communicates with a CPU via a simple 3-wire interface
- 3V operation



DS1670
20-pin TSSOP
20-pin SOIC

DS1608 and DS2404 EconoRAM Time Chips

Lasered ROM serial number

Features

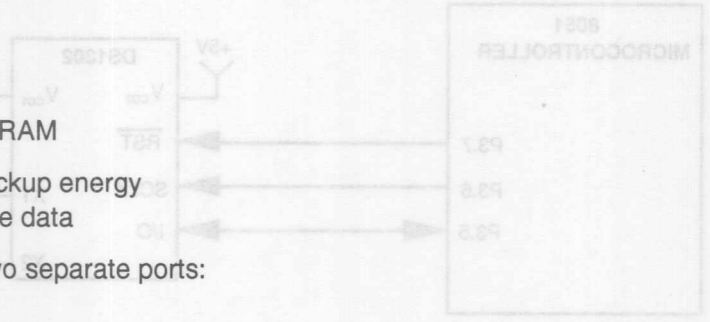
- Offer a simple solution to obtaining time/date information as well as nonvolatile data storage in a system
- Provide the following:
  - Real time clock
  - Unique, 64-bit serial number
  - Interval timer
  - Power cycle counter
  - Programmable interrupts
  - 4096 bits of nonvolatile SRAM
- Standalone operation via backup energy sources maintains nonvolatile data
- Can be accessed through two separate ports: 1-wire and 3-wire
- 3V to 5V operation

1-Wire

- Only one pin required for communication
- Lasered ROM serial number can be read even when the part is without power

3-Wire

- Provides high-speed communication using the traditional Dallas Semiconductor 3-wire interface

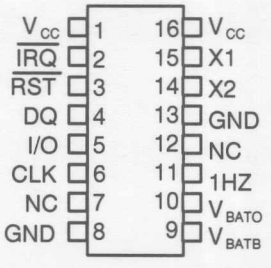


DS1608

Differences between the DS1608 and DS2404 include:

- The clock oscillator is permanently enabled in the DS1608
- The 64-bit serial number is fixed with the DS1608

See the data sheets for additional differences.



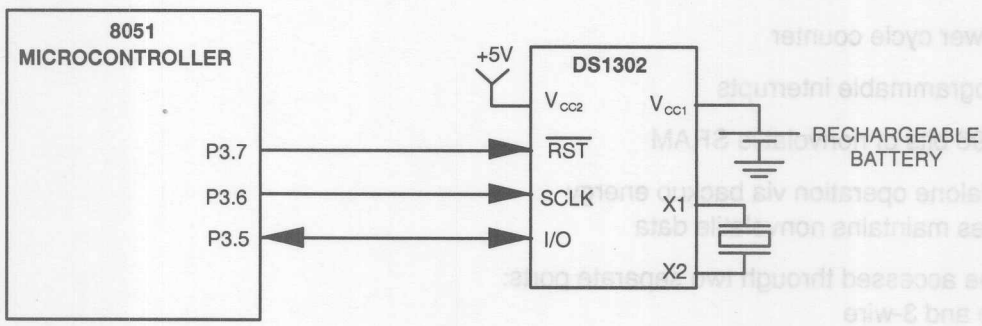
16-pin DIP (DS2404 only)
16-pin SOIC
16-pin SSOP

Application #1: Interfacing an 8051 Microcontroller with a DS1302

In this application, a DS1302 Trickle Charge Timekeeping Chip is interfaced with an 8051 microcontroller. Each of the three lines from the DS1302 is connected to the bi-directional P3 bus of the 8051. This configuration can be used for any of the Dallas Semiconductor 3-wire interface devices.

In this configuration, the DS1302 has its trickle charge circuit enabled and is being backed up by a rechargeable battery. The rechargeable battery could also be replaced by a super cap (~1F). If the trickle charge circuit is disabled, the device can be backed up with a 3V lithium battery.

This configuration can be used for any of the Dallas Semiconductor 3-wire interface devices.



Application #2: 3-Wire Interface Demonstration in Pseudo Code

The following is a listing of pseudo code that demonstrates the use of the Dallas Semiconductor 3-wire interface. This code is designed around the DS1202, DS1302 timekeeping registers; however, the basic 3-wire bit programming is the same for all Dallas Semiconductor 3-wire devices.

Demonstrates the use of the Dallas Semiconductor 3-wire interface

```
/* This code is a listing of subroutines that handle various types of activities involved with using the 3-wire in-
   terface.  These activities are: writing a single byte of data to the Real Time Clock, writing in the burst mode
   to the real time clock, reading in the burst mode from the real time clock.
   The time information to be written is 12:00 PM Sunday, January 1, 1995.
*/

DEFINE
Command    :    Byte
Data       :    Byte
DataArray  :    Array[0..7] of Byte
SCLK       :    Bit1
RST        :    Bit2
I/O        :    Bit3

/*  WriteByte writes the 8-bit command byte to the RTC and then writes the 8-bit data byte to the register
    specified in the command byte.
*/
SUB WriteByte (Command, Data)
    BEGIN
        CLEARBIT SCLK
        CLEARBIT RST
        CLEARBIT I/O
        SETBIT   RST
        FOR I = 0 TO 7                  /* Write the Command Byte    */
            CLEARBIT     I/O            /* Clear I/O to ensure strong 1 */
            IF COMMAND[I] = 1
                SETBIT   I/O
            CLEARBIT     SCLK           /* Pulse SCLK */
            SETBIT       SCLK
        NEXT I
        FOR I = 0 TO 7                  /* Write the Data Byte       */
            CLEARBIT     I/O            /* Clear I/O to ensure strong 1 */
            IF DATA[I] = 1
                SETBIT   I/O
            CLEARBIT     SCLK           /* Pulse SCLK */
            SETBIT       SCLK
        NEXT I
        CLEARBIT I/O
        CLEARBIT RST
        CLEARBIT SCLK
    END /* WriteByte */

/*  WriteByte writes the 8-bit command byte to the RTC and then writes the data to all of the RTC registers
    in the burst mode.
```

```
*/
SUB WriteBurstMode (Command, DataArray)
    BEGIN
        CLEARBIT SCLK
        CLEARBIT RST
        CLEARBIT I/O
        SETBIT   RST
        FOR I = 0 TO 7                  /* Write the Command Byte   */
            CLEARBIT    I/O             /* Clear I/O to ensure strong 1 */
            IF COMMAND[I] = 1
                SETBIT  I/O
            CLEARBIT    SCLK    /* Pulse SCLK */
            SETBIT      SCLK
        NEXT I
        FOR J = 0 TO 7                  /* Write 8-bytes of data */
            FOR I = 0 TO 7              /* Write the Data Byte      */
                CLEARBIT    I/O /* Clear I/O to ensure strong 1 */
                IF DATAARRAY[J][I] = 1
                    SETBIT  I/O
                CLEARBIT    SCLK    /* Pulse SCLK */
                SETBIT      SCLK
            NEXT I
        NEXT J
        CLEARBIT I/O
        CLEARBIT RST
        CLEARBIT SCLK
    END /* WriteBurstMode */
/*  ReadBurstMode writes the 8-bit command byte to the RTC and then reads the data from all of the RTC reg-
isters in the burst mode.
*/
SUB ReadBurstMode (Command, DataArray)
    BEGIN
        CLEARBIT SCLK
        CLEARBIT RST
        CLEARBIT I/O
        SETBIT   RST
        FOR I = 0 TO 7                  /* Write the Command Byte   */
            CLEARBIT    I/O             /* Clear I/O to ensure strong 1 */
            IF COMMAND[I] = 1
                SETBIT  I/O
            CLEARBIT    SCLK    /* Pulse SCLK */
            SETBIT      SCLK    /* SCLK left high for start of read     */
        NEXT I
        FOR J = 0 TO 7                  /* Read 8-bytes of data     */
            FOR I = 0 TO 7              /* Read the Data Byte       */
                SETBIT      SCLK
                CLEARBIT    SCLK    /* Pulse SCLK */
                DATAARRAY[J][I] = I/O
            NEXT I
        NEXT J
        CLEARBIT I/O
        CLEARBIT SCLK
        CLEARBIT RST
    END /* ReadBurstMode */
```

```
/*  The MAIN section of the pseudo code calls each of the previous subroutines to Write the Time/Data information to the Phantom Time Clock and then Read it back.
*/
MAIN
    BEGIN
        Command   = 8EH          /* Disable Write Protect Bit   */
        Data      = 00H
        WRITEBYTE (Command, Data)

        Command   = BEH          /* Write Time/Date to RTC Registers */
        DataArray = {80H, 00H, B2H, 14H, 01H, 01H, 95H, 00H }
        WriteBurstMode (Command, DataArray)

        Command   = 81H          /* Start the Oscillator        */
        Data      = 00H
        WriteByte (Command, Data)

        Command   = 8EH          /* Enable Write Protect Bit    */
        Data      = 80H
        WriteByte (Command, Data)

        Command   = BFH          /* Read Time/Date from RTC  */
        DataArray = {00H, 00H, 00H, 00H, 00H, 00H, 00H, 00H }
        ReadBurstMode (Command, DataArray)

    END /* Main */
```

What's Available in Phantom Clocks?

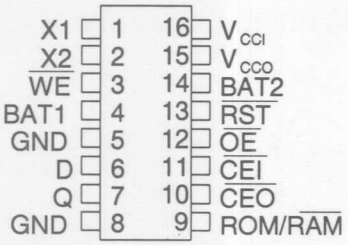
- **DS1215, DS1315** *Phantom Time Chips*
- **DS1216B, C, D, E, F** *SmartWatch Intelligent Sockets*
- **DS1243Y, DS1244Y, DS1248Y, DS1251Y** *NV SRAM with Phantom Clock*

DS1215, DS1315 Phantom Time Chips

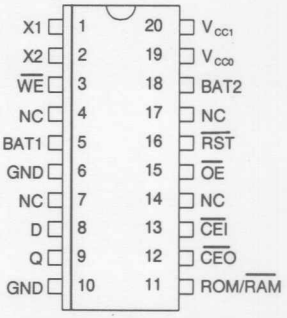
Features

Clock operation is transparent to the system.

- Combine CMOS timekeeper and nonvolatile memory controller
- Keep track of hundredths of seconds, seconds, minutes, hours, days, date of the month, months, and years
- External battery maintains timekeeping operation and provides power for a CMOS static RAM
- Nonvolatile controller supplies all the necessary support circuitry to convert a CMOS RAM to a nonvolatile memory
- Clock operation is transparent to the system until the timekeeping information is requested
- Can be interfaced with either RAM or ROM without leaving gaps in memory
- No address space required
- Support redundant batteries for high reliability applications



16-pin DIP
16-pin SOIC



20-pin TSSOP
(DS1315 only)

DS1216B, C, D, E, F SmartWatch Intelligent Sockets

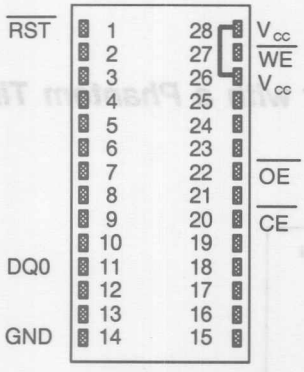
Features

The SmartWatch is a 600 mil-wide DIP socket with a built-in DS1215 Phantom Real Time Chip (providing timekeeping functions and nonvolatile RAM control), an embedded lithium energy source, and a 32.768 kHz crystal. When the socket is mated with a bytewide CMOS static RAM (DS1216B,C,D) that has at most 1µA of standby current, it provides a complete solution to problems associated with memory volatility and uses a common energy source to maintain time and date for up to 10 years. The SmartWatch can also be mated with a ROM (DS1216E,F) to provide timekeeping capabilities only.

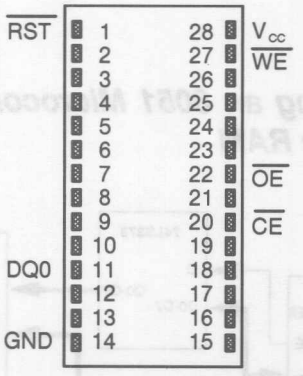
The SmartWatch allows a transparent real time clock function to be retrofitted in a system with a bytewide memory socket where there are no provisions to support such a function. The SmartWatch is transparent to the RAM/ROM memory map because it does not occupy any of the existing RAM/ROM locations. These devices are termed "Phantom" because the timekeeper is accessed only when a predetermined 64-bit pattern has been received by the device. When the timekeeper is not being accessed, the RAM/ROM can be accessed normally.

- Keep track of hundredths of seconds, seconds, minutes, hours, days, date of the month, months, and years
- Convert standard CMOS static RAM into nonvolatile memory
- Embedded lithium energy cell maintains watch information and retains RAM data
- Watch function is transparent to RAM operation
- Leap year automatically corrected
- Accuracy is better than ± 1 minute/month @ 25°C

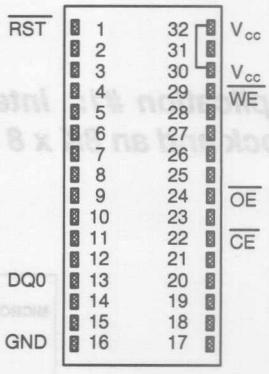
Convert standard CMOS static RAM into nonvolatile memory



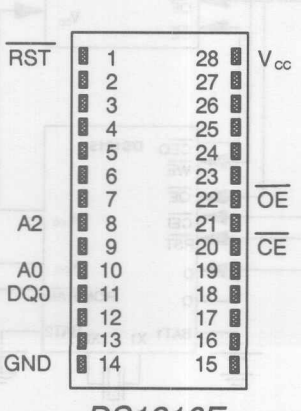
DS1216B
28-pin Socket



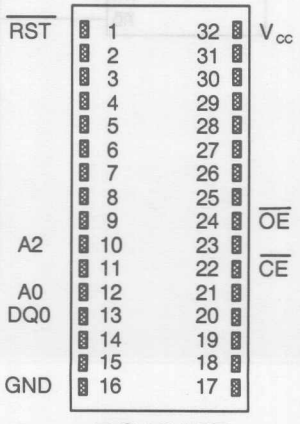
DS1216C
28-pin Socket



DS1216D
32-pin Socket



DS1216E
28-pin Socket



DS1216F
32-pin Socket

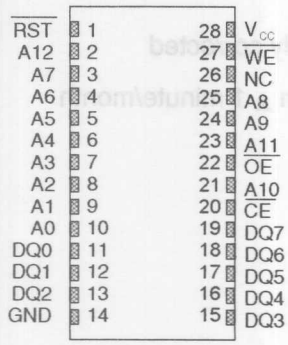
DALLAS SEMICONDUCTOR

DS1243Y, DS1244Y, DS1248Y, DS1251Y NV SRAM with Phantom Clock

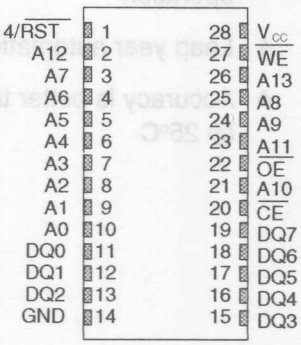
Features

- Fully nonvolatile static RAM
- Built-in Phantom clock
- Embedded lithium energy source
- Contain 32.768 kHz crystal
- Operate identically to a DS1216 with a low standby current SRAM inserted
- Maintain over 10 years data retention in the absence of system power
- Provide a transparent Phantom Time Clock to the system

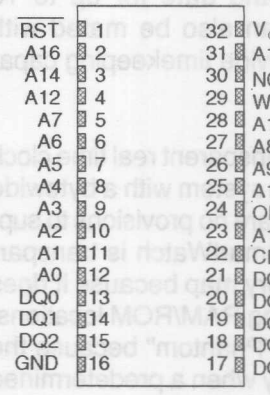
Fully nonvolatile static RAM with built-in Phantom clock



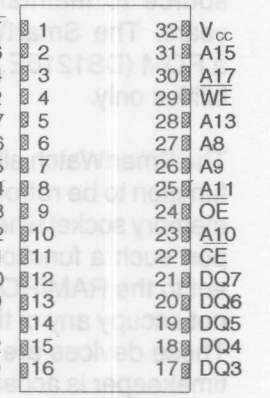
DS1243Y
28-pin Encap. Module



DS1244Y
28-pin Encap. Module

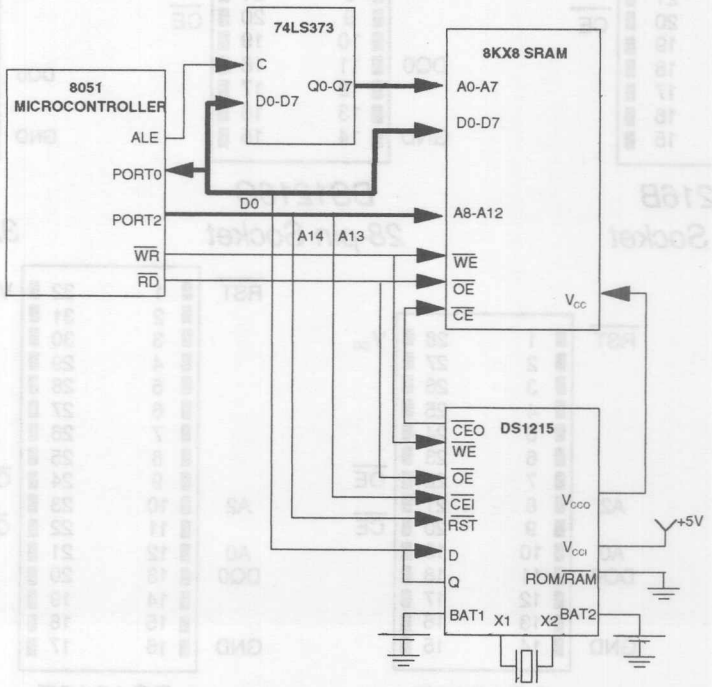


DS1248Y
32-pin Encap. Module



DS1251Y
32-pin Encap. Module

Application #1: Interfacing an 8051 Microcontroller with a Phantom Time Clock and an 8K x 8 Static RAM



Application #2: Accessing the Phantom Clock in Pseudo Code

The following is a listing of pseudo code that demonstrates the accessing of the Phantom Time Clock. An example of source code for interfacing the Phantom Time Clock with the 8051 microcontroller can be found in Dallas Semiconductor Application Note 52, "Using the Dallas Phantom Real Time Clocks."

Demonstrates accessing the Phantom Time Clock

```
/* This code is a listing of subroutines that handle various types of activities involved with using the
Phantom Time Clocks. These activities are: dummy reads to the clock to ensure that the clock is ready
for the access bytes, sending the 8-byte access code, writing to the Phantom Time Clock, and reading
from the Phantom Time Clock.
    The time information to be written is 12:00 PM Wednesday, January 1, 1992. Also, note that the oscillator,
OSC bit, has been enabled and the RESET bit was disabled.
*/

DEFINE
A  :    Array[0..7] = {C5, 3A, A3, 5C, C5, 3A, A3, 5C}    /* Define Access Pattern  */
T  :    Array[0..7] = {00, 00, 00, B2, 14, 01, 01, 92}    /* Time / Date */
X  :    Byte at 1000                                      /* Memory Location 1000H */
D  :    Array[0..7]
S  :    Byte

/*  ClearClock performs 65 Reads from the Phantom Time Clock.  This ensures that the Phantom Time Clock
is ready to begin accepting the access bytes.
*/
SUB ClearClock
    BEGIN
        FOR I = 0 TO 64                          /* Perform 65 Reads                */
            S = X
        NEXT I
    END /* ClearClock */

/*  GetAccess writes the 8-byte access code to the Phantom Time Clock                */
SUB GetAccess (A : Array[0..7])
    BEGIN
        FOR I = 0 TO 7                           /* Loop for 8 bytes                */
            FOR J = 0 TO 7                       /* Loop for 8 bits                 */
                X = A[I] SHR J                   /* Write to X, Shift bits right J  */
            NEXT J
        NEXT I
    END /* GetAccess */

/*  WriteClock writes 8 bytes of data to the Phantom Time Clock                      */
SUB WriteClock (T : Array[0..7])
    BEGIN
        FOR I = 0 TO 7                           /* Loop for 8 bytes                */
            FOR J = 0 TO 7                       /* Loop for 8 bits                 */
                X = T[I] SHR J                   /* Write to X, Shift bits right J  */
            NEXT J
        NEXT I
    END /* WriteClock */

/*  ReadClock reads 8-bytes of data from the Phantom Time Clock                      */
SUB ReadClock (D : Array[0..7])
    BEGIN
        FOR I = 0 TO 7                           /* Loop for 8 bytes                */
            D[I] = 0                             /* Initialize the byte             */
            FOR J = 0 TO 7                       /* Loop for 8 bits                 */
                D[I] = D[I] or (X and 1)  SHL J  /* Write to X, Shift bits right J  */
            NEXT J
        NEXT I
    END /* ReadClock */

/*  The MAIN section of the pseudo code calls each of the previous subroutines to Write the Time/Data
information to the Phantom Time Clock and then Read it back.
*/
MAIN
        BEGIN
                ClearClock                       /*  Write Time/Date Information   */
                GetAccess (A)                    /*  to the Phantom Time Clock.    */
                WriteClock (T)

                ClearClock                       /*  Read Time/Date Information    */
                GetAccess (A)                    /*  from the Phantom Time Clock.  */
                ReadClock (D)
        END /* Main */
```

What's Available in Nonvolatile Timekeeping RAMs?

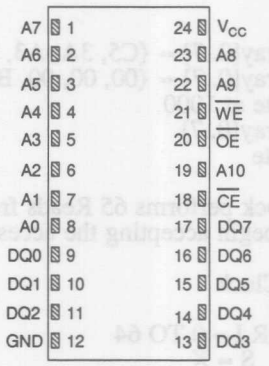
- **DS1642, DS1643, DS1644, DS1646, DS1647** *Nonvolatile Timekeeping RAM Modules*
- **DS1644L, DS1646L, DS1647L** *Nonvolatile Timekeeping RAM Low Profile Modules*

DS1642, DS1643, DS1644, DS1646, DS1647 NV Timekeeping RAM Modules

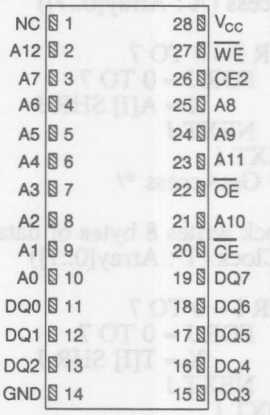
Directly addressable bytewide RAM and BCD formatted timekeeping registers

Features

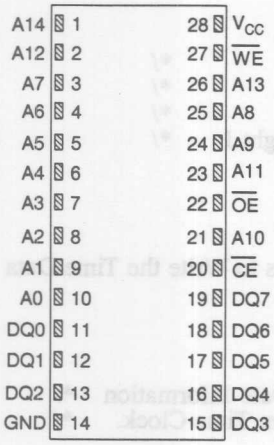
- Integrate a real time clock function with various configurations of nonvolatile SRAM
- Self-contained package includes NV SRAM, real time clock, crystal, power control circuit, and lithium energy source
- JEDEC standard pinouts with directly addressable bytewide RAM- and BCD-formatted timekeeping registers
- Allow for a simple HW/SW device interface design
- Require no additional external components
- Maintain timekeeping and memory in the absence of system power for a minimum period of 10 years with an accuracy of ± 1 minute/month at 25°C



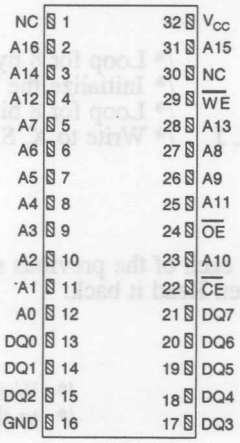
DS1642
24-pin DIP Module



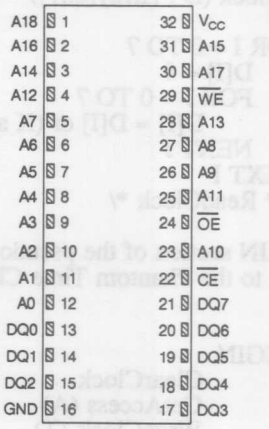
DS1643
28-pin DIP Module



DS1644
28-pin DIP Module



DS1646
32-pin DIP Module



DS1647
32-pin DIP Module
(Contact Factory For Availability)

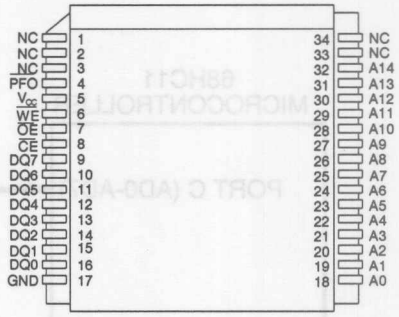
DS1644L, DS1646L, DS1647L NV Timekeeping RAM Low Profile Modules

These Timekeeping RAM Modules provide identical functions and performance to their dual-in-line packaged counterparts. The Low Profile Module is a PLCC package which, when combined with a low-cost, surface mountable socket, provides a surface mount solution option to the NV Timekeeping RAM product family.

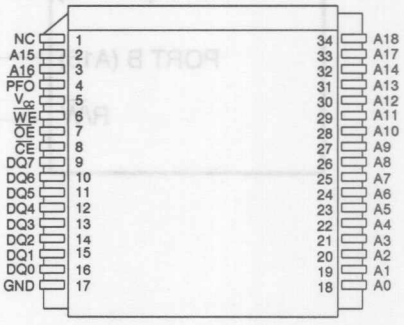
Provide a surface mount solution option to the NV Timekeeping RAM product family

Features

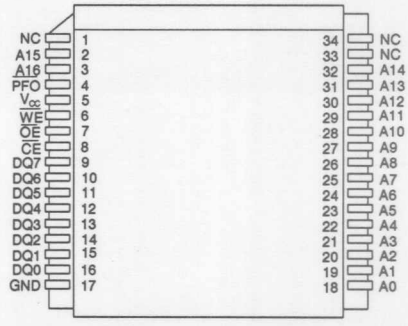
- Integrate a real time clock function with various configurations of nonvolatile SRAM
- Self-contained package includes NV SRAM, real time clock, crystal, power control circuit, and lithium energy source
- Directly addressable bytewide RAM- and BCD-formatted timekeeping registers
- Allow for a simple HW/SW device interface design
- Maintain timekeeping and memory in the absence of system power for a minimum period of 10 years with an accuracy of ± 1 minute/month at 25°C



DS1644L
34-pin Low Profile Module



DS1647L
34-pin Low Profile Module
(Contact Factory For Availability)

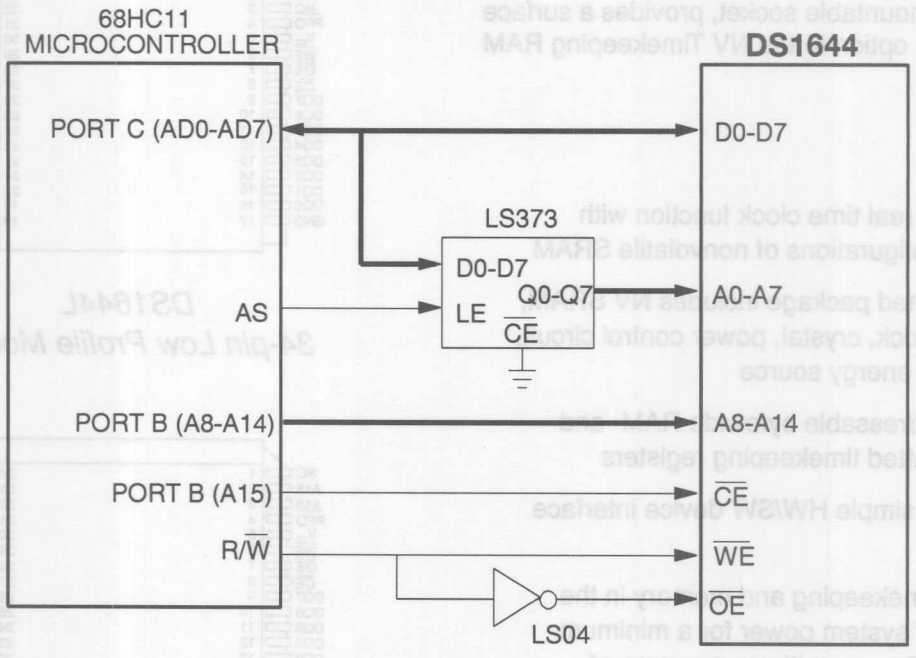


DS1646L
34-pin Low Profile Module

Application #1: Interfacing a Simple Microcontroller to the DS1644

The application example below demonstrates a simple microcontroller interface to the DS1644. Multiplexed port C of the 64HC11 is used to provide both the output of eight LSBs of memory address and input/output of the data byte from the desired memory location. Port B of the 68HC11 is used to provide the 7 MSBs of memory address. With this arrangement, the 68HC11 has direct access to 32K bytes of nonvolatile RAM and a real time clock.

The 68HC11 has direct access to 32K bytes of nonvolatile RAM and a real time clock.



What's Available in Watchdog Timekeepers?

- **DS1284, DS1384** *Watchdog Timekeeping Chip*
- **DS1286, DS1386, DS1486** *Watchdog Timekeeping Modules*

DS1284 and DS1384 Watchdog Timekeeping Chips

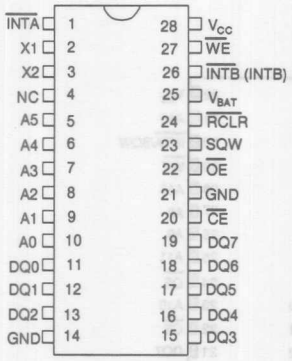
The DS1284 and DS1384 Watchdog Timekeeping Chips provide four functions for a processor or controller: nonvolatile SRAM, real time clock/calendar, clock/calendar alarms, and watchdog timer. Two highly programmable interrupts and a square wave output provide an external interface to alarm and/or watchdog events and a precise clock reference. Additionally, 50 bytes of directly addressable RAM are available for uses such as system configuration storage, scratchpad area, etc. An external crystal and battery are the only additional components necessary to provide these functions and maintain timekeeping and memory in the absence of power.

The DS1384 provides the additional capability of nonvolatizing external SRAM with densities up to 128K x 8.

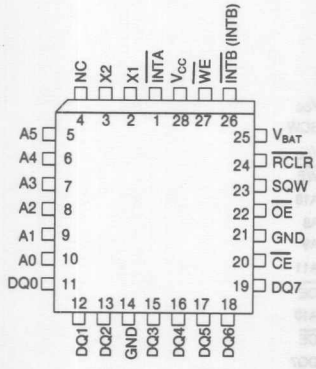
Features

- Keep track of hundredths of seconds, seconds, minutes, hours, days, date of the month, months, and years
- Watchdog timer restarts an out-of-control processor
- Alarm function provides notice of real time-related event
- Programmable interrupts and square wave outputs maintain 28-pin JEDEC footprint
- All registers are individually addressable via the address and data bus
- Accuracy is better than ± 2 minutes/month at 25°C
- 50 bytes of user nonvolatile RAM
- Low-power CMOS circuitry is maintained on less than 1µA in standby mode
- Interrupt outputs active during battery backup mode

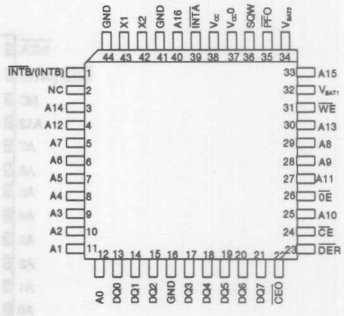
Two highly programmable interrupts and a square wave output provide an external interface to alarm and/or watchdog events and a precise clock reference.



DS1284
28-pin DIP



DS1284Q
28-pin PLCC



DS1384
44-pin QFP

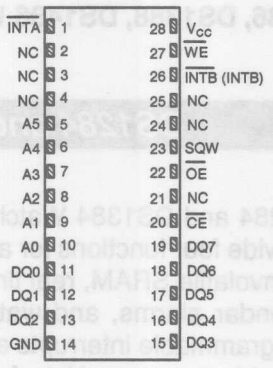
DALLAS SEMICONDUCTOR

DS1286, DS1386, DS1486 Watchdog Timekeeping Modules

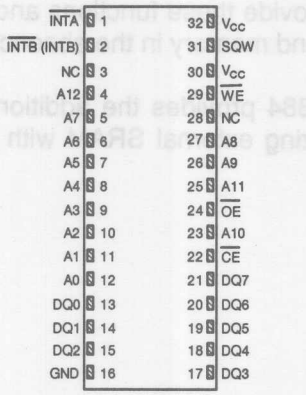
Features

- Provide four functions for a processor or controller:
  - Nonvolatile SRAM
  - Real time clock/calendar
  - Clock/calendar alarms
  - Watchdog timer
- Two highly programmable interrupts and a square wave output provide an external interface to alarm and/or watchdog events and a precise clock reference
- Various configurations of directly addressable nonvolatile RAM are available for uses such as general storage, system configuration, scratchpad area, etc.
  - DS1286 - 50 bytes
  - DS1386 - 8K or 32K bytes
  - DS1486 - 128K bytes
- Self-contained packages
- Eliminate the need for any additional external components
- Maintain timekeeping and memory in the absence of system power for a minimum of 10 years with an accuracy of ± 1 minute/month at 25°C
- Interrupt outputs active during battery back mode

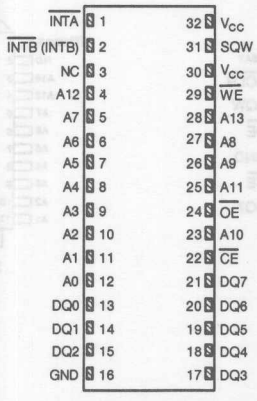
Various configurations of directly addressable nonvolatile RAM are available



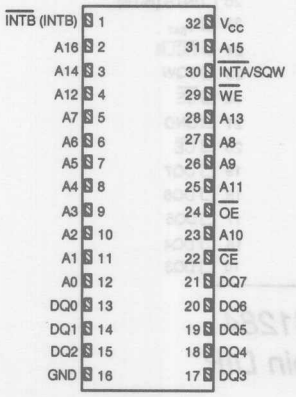
DS1286
28-pin DIP Module



DS1386-8
32-pin DIP Module



DS1386-32
32-pin DIP Module

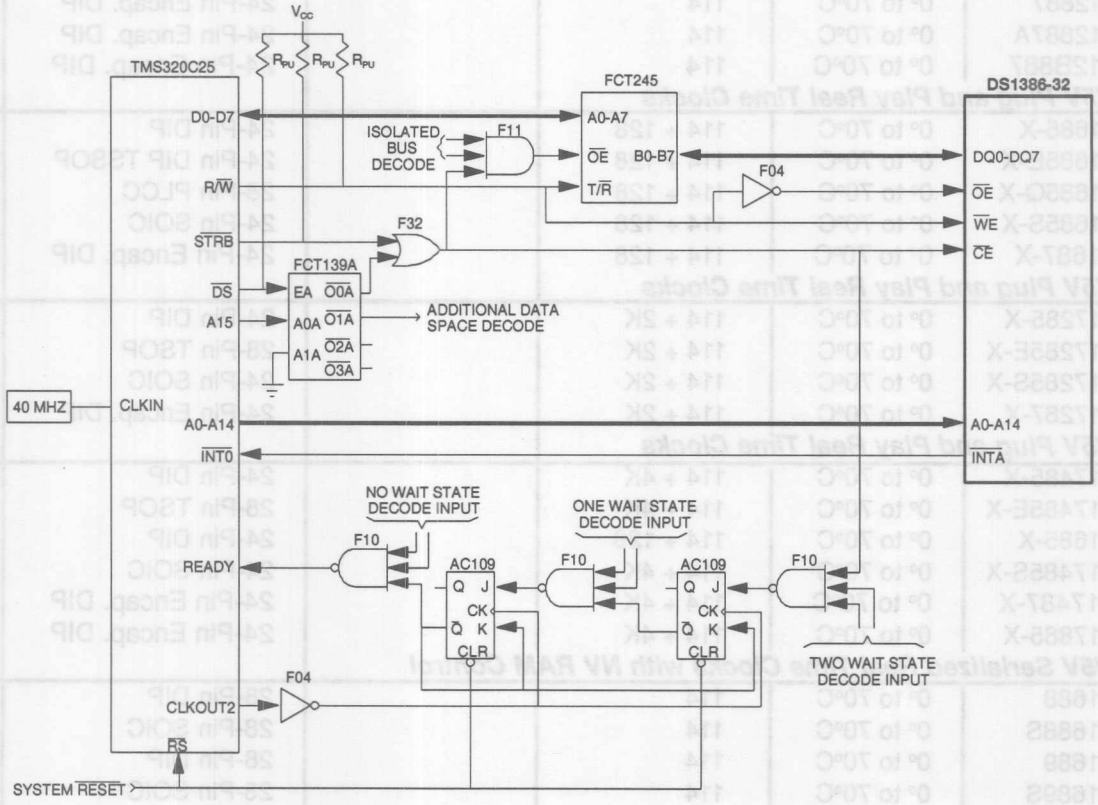


DS1486
32-pin DIP Module

Application #1: Interfacing a Digital Signal Processor to the DS1386-32

The application example below demonstrates a possible digital signal processor interface to the DS1386-32. In this example, the $\overline{INTA}$ output is intended to generate a periodic interrupt based upon a continuous occurrence of a watchdog timeout. The periodic interrupt would be used to schedule sampling and update operations commonly required in DSP applications. The DS1386-32 is mapped into the lower 32K bytes of the DSP's 64K bytes of data memory space. The FCT245 (or equivalent) is required to isolate the DSP data bus to avoid bus collisions due to DS1386 turn off times. A two-wait state implementation is shown to extend DSP interface timing to accommodate the 150 ns version of the DS1386; one wait state could be used with the 120 ns version. As an alternative to reduce chip count, the interface decode and wait state logic could be implemented with a suitable PLD.

Used to schedule common sampling and update operations



Ordering Information

Part No.	Temperature	RAM Size	RAM Access	Package	Availability
PC Real Time Clocks					
Serialized Real Time Clocks					
DS1585	0° to 70°C	114 + 8K		28-Pin DIP	NOW
DS1585S	0° to 70°C	114 + 8K		28-Pin SOIC	NOW
DS1587	0° to 70°C	114 + 8K		28-Pin Encap. DIP	NOW
Real Time Clocks					
DS12885	0° to 70°C	114		24-Pin DIP	NOW
DS12885N	-40° to +85°C	114		24-Pin DIP	NOW
DS12885Q	0° to 70°C	114		28-Pin PLCC	NOW
DS12885QN	-40° to +85°C	114		28-Pin PLCC	NOW
DS12885S	0° to 70°C	114		24-Pin SOIC	NOW
DS12885SN	-40° to +85°C	114		24-Pin SOIC	NOW
DS12885T	0° to 70°C	114		32-Pin TQFP	NOW
DS12887	0° to 70°C	114		24-Pin Encap. DIP	NOW
DS12887A	0° to 70°C	114		24-Pin Encap. DIP	NOW
DS12B887	0° to 70°C	114		24-Pin Encap. DIP	NOW
3V/5V Plug and Play Real Time Clocks					
DS1685-X	0° to 70°C	114 + 128		24-Pin DIP	NOW
DS1685E-X	0° to 70°C	114 + 128		24-Pin DIP TSSOP	NOW
DS1685Q-X	0° to 70°C	114 + 128		28-Pin PLCC	NOW
DS1685S-X	0° to 70°C	114 + 128		24-Pin SOIC	NOW
DS1687-X	0° to 70°C	114 + 128		24-Pin Encap. DIP	NOW
3V/5V Plug and Play Real Time Clocks					
DS17285-X	0° to 70°C	114 + 2K		24-Pin DIP	NOW
DS17285E-X	0° to 70°C	114 + 2K		28-Pin TSOP	NOW
DS17285S-X	0° to 70°C	114 + 2K		24-Pin SOIC	NOW
DS17287-X	0° to 70°C	114 + 2K		24-Pin Encap. DIP	NOW
3V/5V Plug and Play Real Time Clocks					
DS17485-X	0° to 70°C	114 + 4K		24-Pin DIP	NOW
DS17485E-X	0° to 70°C	114 + 4K		28-Pin TSOP	NOW
DS1685-X	0° to 70°C	114 + 128		24-Pin DIP	NOW
DS17485S-X	0° to 70°C	114 + 4K		24-Pin SOIC	NOW
DS17487-X	0° to 70°C	114 + 4K		24-Pin Encap. DIP	NOW
DS17885-X	0° to 70°C	114 + 4K		24-Pin Encap. DIP	NOW
3V/5V Serialized Real Time Clocks with NV RAM Control					
DS1688	0° to 70°C	114		28-Pin DIP	NOW
DS1688S	0° to 70°C	114		28-Pin SOIC	NOW
DS1689	0° to 70°C	114		28-Pin DIP	NOW
DS1689S	0° to 70°C	114		28-Pin SOIC	NOW
DS1689SN	-40° to +85°C	114		28-Pin SOIC	NOW
DS1691	0° to 70°C	114		28-Pin Encap. DIP	NOW
DS1693	0° to 70°C	114		28-Pin Encap. DIP	NOW
Real Time Clock with NV RAM Control					
DS14285	0° to 70°C	114		24-Pin DIP	NOW
DS14285N	-40° to +85°C	114		24-Pin DIP	NOW
DS14285Q	0° to 70°C	114		28-Pin PLCC	NOW
DS14285QN	-40° to +85°C	114		28-Pin PLCC	NOW
DS14285S	0° to 70°C	114		24-Pin SOIC	NOW
DS14285SN	-40° to +85°C	114		24-Pin SOIC	NOW
DS14287	0° to 70°C	114		24-Pin Encap. DIP	NOW
RAMified Real Time Clocks					
DS1385	0° to 70°C	50 + 4K		24-Pin DIP	NOW
DS1385S	0° to 70°C	50 + 4K		28-Pin SOIC	NOW

NOTE: *"X" suffix indicates +3 or +5-volt operation.*

Ordering Information

Part No.	Temperature	RAM Size	RAM Access	Package	Availability
DS1387	0° to 70°C	50 + 4K		24-Pin Encap. DIP	NOW
DS1485	0° to 70°C	50 + 8K		24-Pin DIP	NOW
DS1485S	0° to 70°C	50 + 8K		28-Pin SOIC	NOW
DS1488	0° to 70°C	50 + 8K		24-Pin Encap. DIP	NOW
Serial Clocks					
Serial Alarm Time Clock					
DS1305	0° to 70°C	96		16-Pin DIP (300 mil)	NOW
DS1305N	-40° to +85°C	96		16-Pin DIP (300 mil)	NOW
DS1305E	0° to 70°C	96		20-Pin TSSOP	NOW
DS1305EN	-40° to 85°C	96		20-Pin TSSOP	NOW
DS1306	0° to 70°C	96		16-Pin DIP	NOW
DS1306N	-40° to +85°C	96		16-Pin DIP	NOW
DS1306E	0° to 70°C	96		20-Pin TSSOP	NOW
DS1306EN	-40° to 85°C	96		20-Pin TSSOP	NOW
Serial Time Chips					
DS1202	0° to 70°C	24		8-Pin DIP (300 mil)	NOW
DS1202N	-40° to +85°C	24		8-Pin DIP (300 mil)	NOW
DS1202S-8	0° to 70°C	24		8-Pin SOIC (200 mil)	NOW
DS1202SN-8	-40° to +85°C	24		8-Pin SOIC (200 mil)	NOW
DS1202S	0° to 70°C	24		16-Pin SOIC (300 mil)	NOW
DS1202SN	-40° to +85°C	24		16-Pin SOIC (300 mil)	NOW
DS1302	0° to 70°C	31		8-Pin DIP (300 mil)	NOW
DS1302N	-40° to +85°C	31		8-Pin DIP (300 mil)	NOW
DS1302S	0° to 70°C	31		8-Pin SOIC (200 mil)	NOW
DS1302SN	-40° to +85°C	31		8-Pin SOIC (200 mil)	NOW
DS1302Z	0° to 70°C	31		8-Pin SOIC (150 mil)	NOW
DS1302ZN	-40° to +85°C	31		8-Pin SOIC (150 mil)	NOW
64 x 8 Serial Real Time Clock					
DS1307	0° to 70°C	56		8-Pin DIP (300 mil)	NOW
DS1307N	-40° to +85°C	56		8-Pin DIP (300 mil)	NOW
DS1307Z	0° to 70°C	56		8-Pin SOIC (150 mil)	NOW
DS1307ZN	-40° to +85°C	56		8-Pin SOIC (150 mil)	NOW
Elapsed Time Counter					
DS1602	-40° to +85°C			8-Pin DIP (300 mil)	NOW
DS1602S	-40° to +85°C			8-Pin SOIC (200 mil)	NOW
DS1603	0° to 70°C			7-Pin SIP	NOW
EconoRAM Time Chip					
DS2404-001	-40° to +85°C	512		16-Pin DIP (300 mil)	NOW
DS2404B	-40° to +85°C	512		16-Pin SOIC (300 mil)	NOW
DS2404S-001	-40° to +85°C	512		16-Pin SSOP (200 mil)	NOW
Portable System Controller					
DS1670S	0° to 70°C			20-Pin SOIC (300 mil)	NOW
DS1670E	0° to 70°C			20-Pin TSSOP	NOW
Phantom Clocks					
Phantom Time Chips					
DS1215	0° to 70°C			16-Pin DIP (300 mil)	NOW
DS1215N	-40° to +85°C			16-Pin DIP (300 mil)	NOW
DS1215S	0° to 70°C			16-Pin SOIC (300 mil)	NOW
DS1215SN	-40° to +85°C			16-Pin SOIC (300 mil)	NOW
DS1315-X	0° to 70°C			16-Pin DIP (300 mil)	*
DS1315N-X	-40° to +85°C			16-Pin DIP (300 mil)	*
DS1315E-X	0° to 70°C			20-Pin TSSOP	*
DS1315EN-X	-40° to +85°C			20-Pin TSSOP	*
DS1315S-X	0° to 70°C			16-Pin SOIC (300 mil)	*
DS1315SN-X	-40° to +85°C			16-Pin SOIC (300 mil)	*

***Contact Factory For Availability**

Ordering Information

Part No.	Temperature	RAM Size	RAM Access	Package	Availability
SmartWatch Intelligent Sockets					
DS1216B	0° to 70°C	2K, 8K		28-Pin Socket	NOW
DS1216C	0° to 70°C	8K, 32K		28-Pin Socket	NOW
DS1216D	0° to 70°C	8K, 32K,128K, 512K		32-Pin Socket	NOW
DS1216E	0° to 70°C	8K, 32K(ROM)		28-Pin Socket	NOW
DS1216F	0° to 70°C	8K, 32K,128K(ROM)		32-Pin Socket	NOW
NV SRAMs with Phantom Clock					
DS1243Y-120	0° to 70°C	8K	120ns	28-Pin Encap. DIP	NOW
DS1243Y-150	0° to 70°C	8K	150ns	28-Pin Encap. DIP	NOW
DS1243Y	0° to 70°C	8K	200ns	28-Pin Encap. DIP	NOW
DS1244Y-120	0° to 70°C	32K	120ns	28-Pin Encap. DIP	NOW
DS1244Y-150	0° to 70°C	32K	150ns	28-Pin Encap. DIP	NOW
DS1244Y	0° to 70°C	32K	200ns	28-Pin Encap. DIP	NOW
DS1248Y-120	0° to 70°C	128K	120ns	32-Pin Encap. DIP	NOW
DS1248Y-150	0° to 70°C	128K	150ns	32-Pin Encap. DIP	NOW
DS1248Y-200	0° to 70°C	128K	200ns	32-Pin Encap. DIP	NOW
DS1251Y-120	0° to 70°C	512K	120ns	32-Pin Encap. DIP	NOW
DS1251Y-150	0° to 70°C	512K	150ns	32-Pin Encap. DIP	NOW
Nonvolatile Timekeeping RAMs					
Nonvolatile Timekeeping RAM Modules					
DS1642-150	0° to 70°C	2K	150ns	24-Pin Module	NOW
DS1642-120	0° to 70°C	2K	120ns	24-Pin Module	NOW
DS1643-150	0° to 70°C	8K	150ns	28-Pin Module	NOW
DS1643-120	0° to 70°C	8K	120ns	28-Pin Module	NOW
DS1644-150	0° to 70°C	32K	150ns	28-Pin Module	NOW
DS1644-120	0° to 70°C	32K	120ns	28-Pin Module	NOW
DS1646-150	0° to 70°C	128K	150ns	32-Pin Module	NOW
DS1646-120	0° to 70°C	128K	120ns	32-Pin Module	NOW
DS1647-150	0° to 70°C	512K	150ns	32-Pin Module	*
DS1647-120	0° to 70°C	512K	120ns	32-Pin Module	*
Nonvolatile Timekeeping RAM Low Profile Modules					
DS1644L-150	0° to 70°C	32K	150ns	34-Pin LPM	NOW
DS1644L-120	0° to 70°C	32K	120ns	34-Pin LPM	NOW
DS1646L-150	0° to 70°C	128K	150ns	34-Pin LPM	NOW
DS1646L-120	0° to 70°C	128K	120ns	34-Pin LPM	NOW
DS1647L-150	0° to 70°C	512K	150ns	34-Pin LPM	*
DS1647L-120	0° to 70°C	512K	120ns	34-Pin LPM	*
Watchdog Timekeepers					
Watchdog Timekeeping Chips					
DS1284	0° to 70°C	50	150ns	28-Pin DIP	NOW
DS1284Q	0° to 70°C	50	150ns	28-Pin PLCC	NOW
DS1284QN	-40° to +85°C	50	150ns	28-Pin PLCC	NOW
DS1384FP-120	0° to 70°C	50	120ns	44-Pin PLCC	NOW
DS1384FP-150	0° to +85°C	50	150ns	44-Pin PLCC	NOW
Watchdog Timekeeping Modules					
DS1286	0° to 70°C	50	150ns	28-Pin Module	NOW
DS1386-8-120	0° to 70°C	8K	120ns	32-Pin Module	NOW
DS1386-8-150	0° to 70°C	8K	150ns	32-Pin Module	NOW
DS1386-32-120	0° to 70°C	32K	120ns	32-Pin Module	NOW
DS1386-32-150	0° to 70°C	32K	150ns	32-Pin Module	NOW
DS1486-120	0° to 70°C	128K	120ns	32-Pin Module	NOW
DS1486-150	0° to 70°C	128K	150ns	32-Pin Module	NOW

***Contact Factory For Availability**

The following is a list of the Dallas Semiconductor Timekeeping devices that meet the requirements for use in products requiring submission to Underwriter Laboratories. The devices listed below, which are on UL card E99151 (R), are considered to meet the requirements for 94-V2 and are provided with the applicable reverse charging current protection circuitry. Please contact the factory for UL status of chips/ modules not currently on the list of approved devices.

CHIPS:		***MODULES:***		
DS1215	DS1385	DS1216x	DS12887	DS1642
DS1283	DS1485	DS1243Y	DS1386	DS1643
DS1284	DS1585	DS1244Y	DS1387	DS1644
DS1285	DS17485	DS1248Y	DS1486	DS1646
DS12885	DS2404	DS1286	DS1587	DS1647
DS1384		DS1287	DS1603	DS17487

Timekeeping Application Notes

The following is a listing of available application notes for the Dallas Semiconductor Timekeeping products. For a copy of any of these publications, call (214) 450-0448 or visit our World Wide Web site at http://www.dalsemi.com/

- ***Application Note 4*** DS1213, DS1216, DS1613 SmartSocket/SmartWatch Options
- ***Application Note 30*** Recording Power Cycling Information Using the DS1602/DS1603
- ***Application Note 52*** Using the Dallas Phantom Real Time Clocks
- ***Application Note 58*** Crystal Considerations with Dallas Real Time Clocks
- ***Application Note 66*** Using the Watchdog Timekeeper
- ***Application Note 77*** DS1585/87, DS1685/87 and DS17x85/87 Accessing Extended User RAM via Software
- ***Application Note 82*** Using the Dallas Tricklecharge Timekeeper
- ***Application Note 90*** Using the PC Clock Extended Features
- ***Application Note 95*** Interfacing the DS1307 with an 8051 Microcontroller
- ***Application Note 100*** DS1670 Portable System Controller